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Davis et al.

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(54) **ULTRAVIOLET SANITIZER WITH WAND**

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(51) **Int. Cl.**
A61L 2/10 (2006.01)

(52) **U.S. Cl.**
CPC ***A61L 2/10*** (2013.01); *A61L 2202/15* (2013.01); *A61L 2202/16* (2013.01); *A61L 2202/24* (2013.01)

(58) **Field of Classification Search**
CPC ... A61L 2/10; A61L 2202/16; A61L 2202/24; A61L 2202/15
USPC ..... 250/455.11, 504 R, 504 H; 607/93, 94, 607/98; 422/24
See application file for complete search history.

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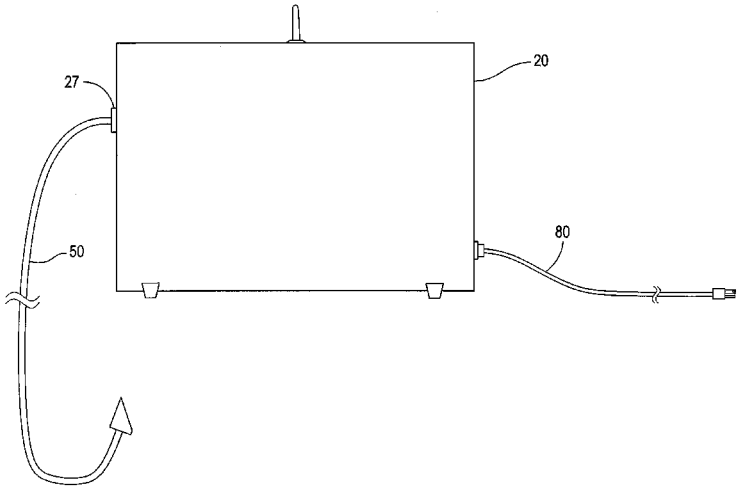
(57) **ABSTRACT**

An ultraviolet sanitizer with flexible wand. A flexible wand is connected to a generator of ultraviolet radiation. The generator is mounted within a housing and connectable to a source of electrical energy. The distal wand end includes a switch for controlling the emission of the ultraviolet radiation from the wand with a distal tip directing the radiation toward the surface to be sanitized.

19 Claims, 15 Drawing Sheets



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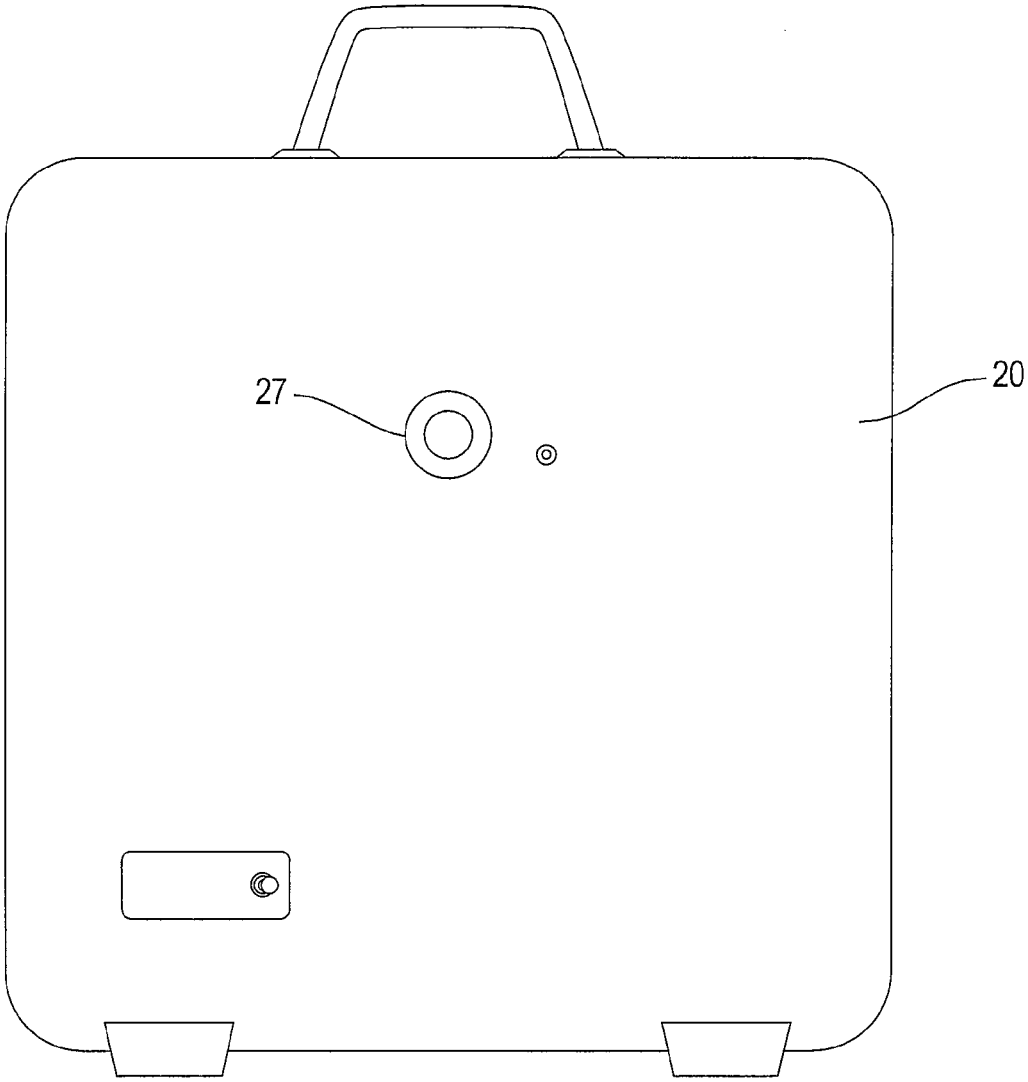


Fig. 1

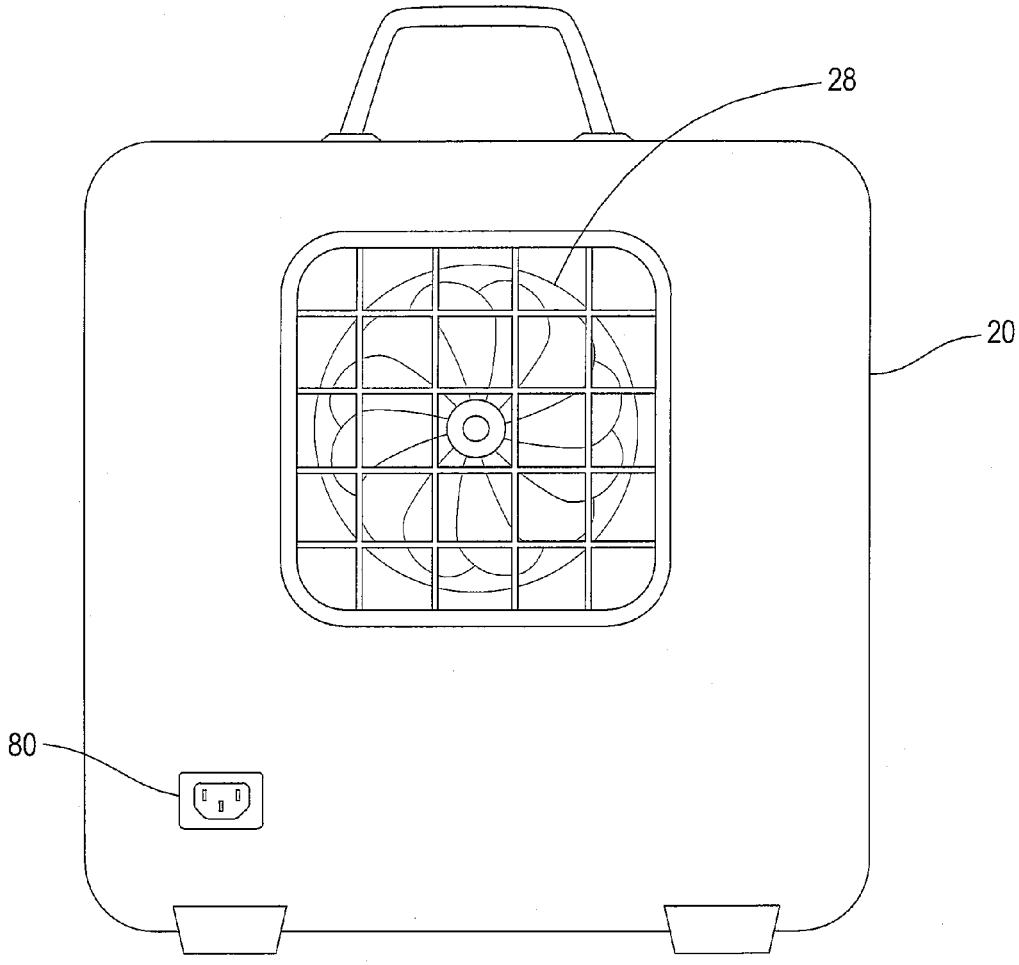
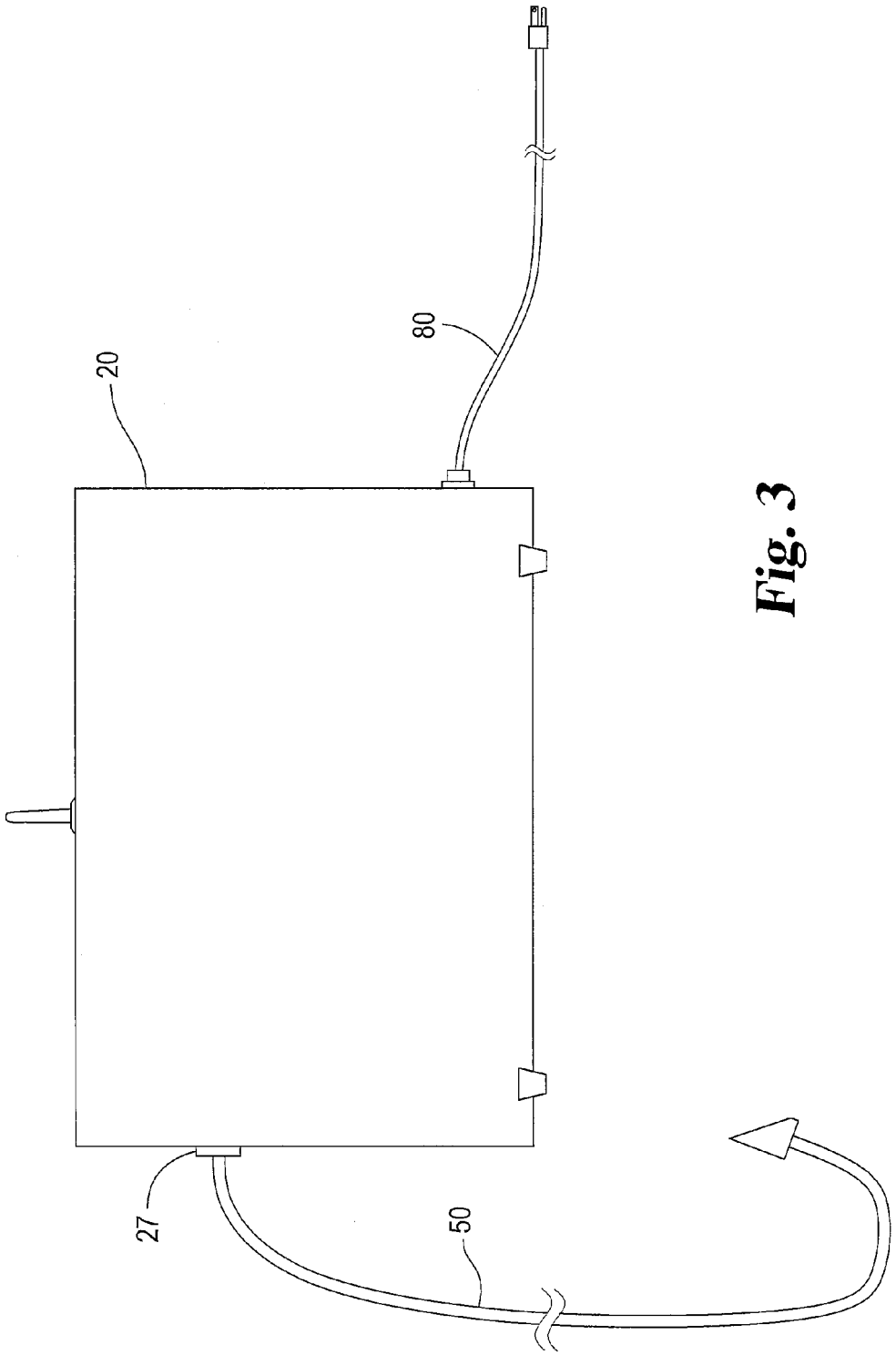


Fig. 2



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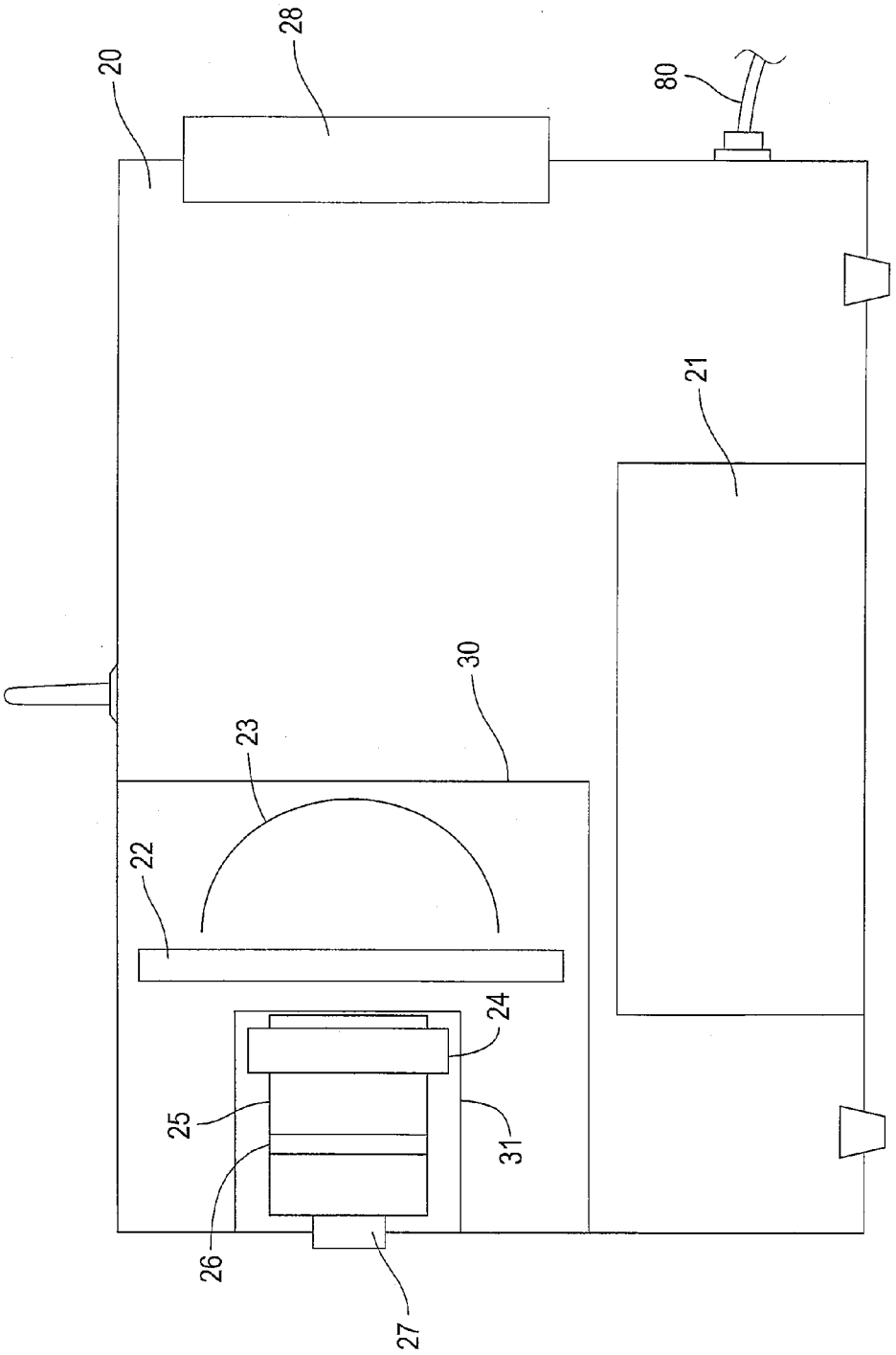

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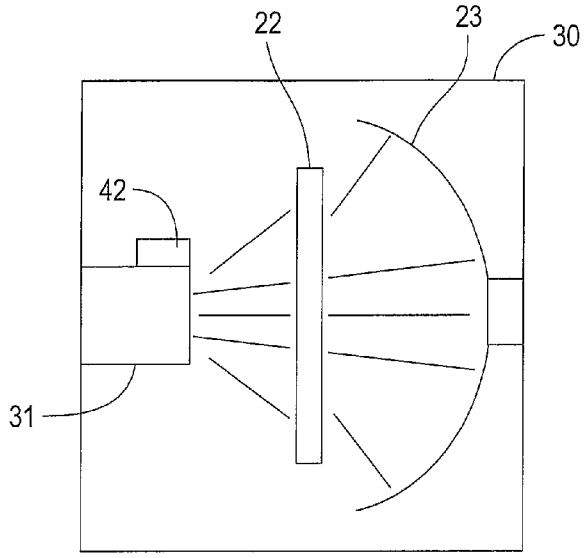
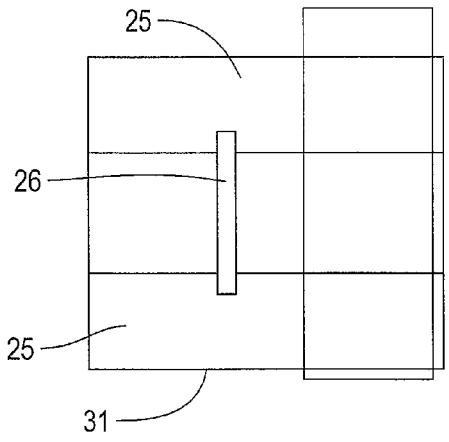


Fig. 5



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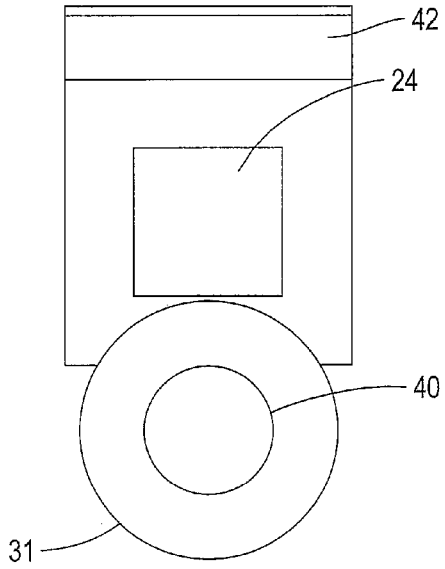

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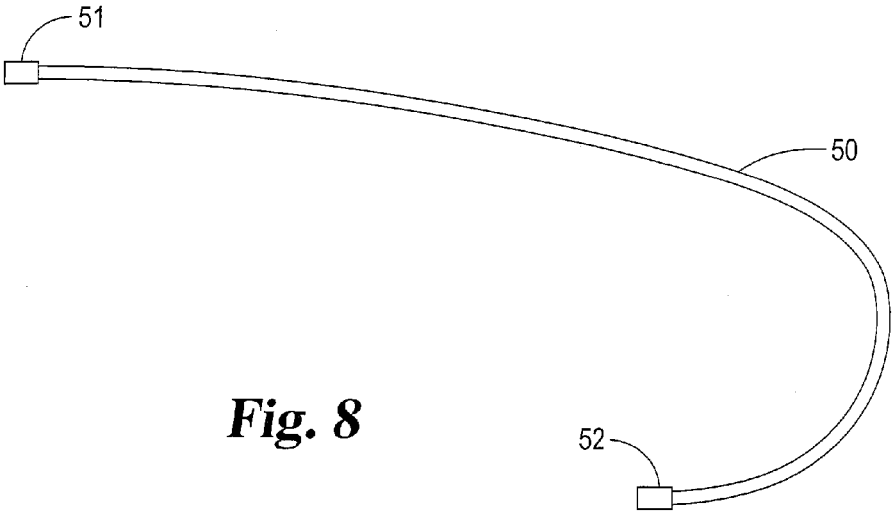
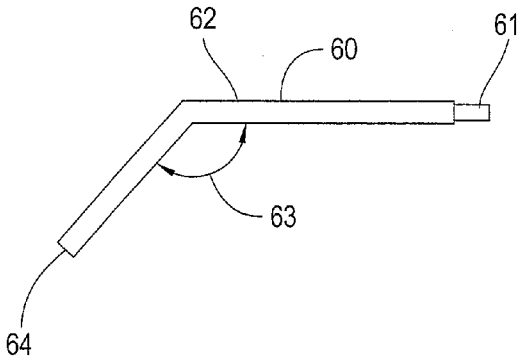


Fig. 8



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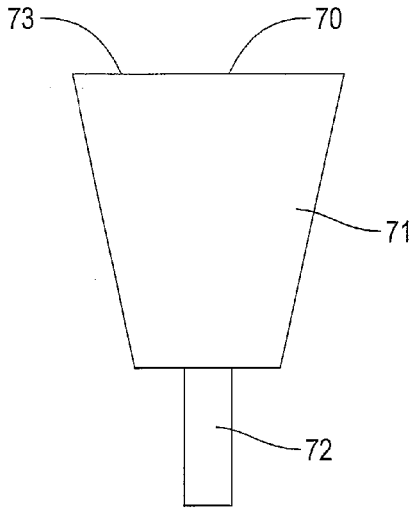


Fig. 10

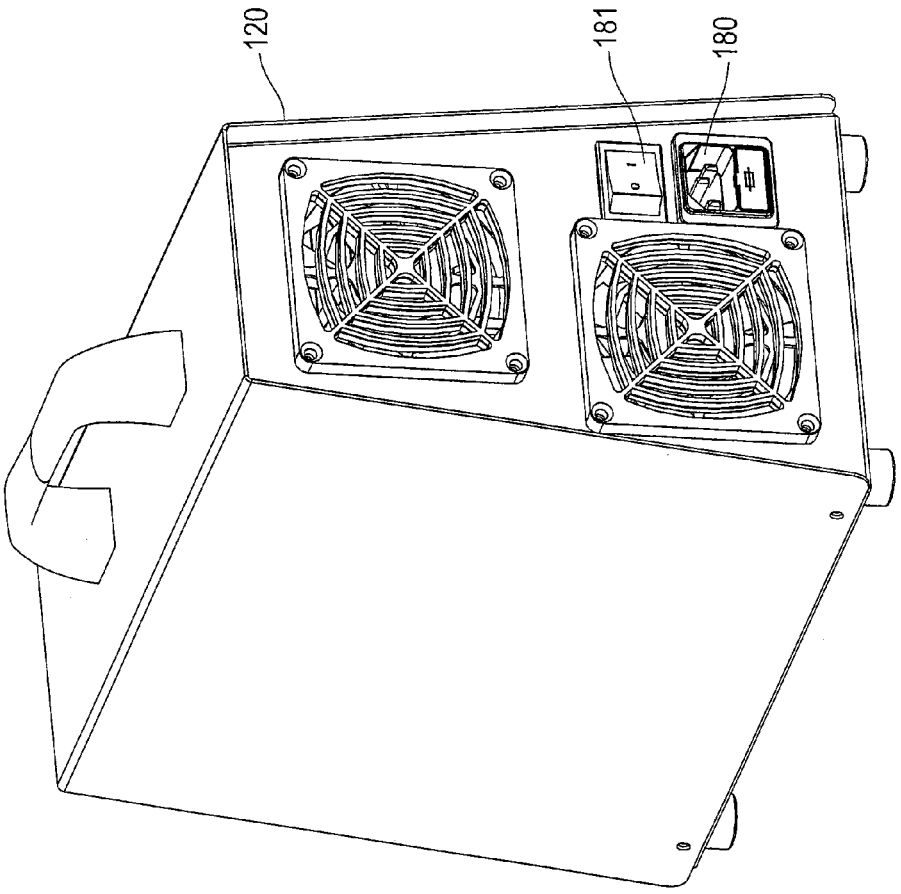
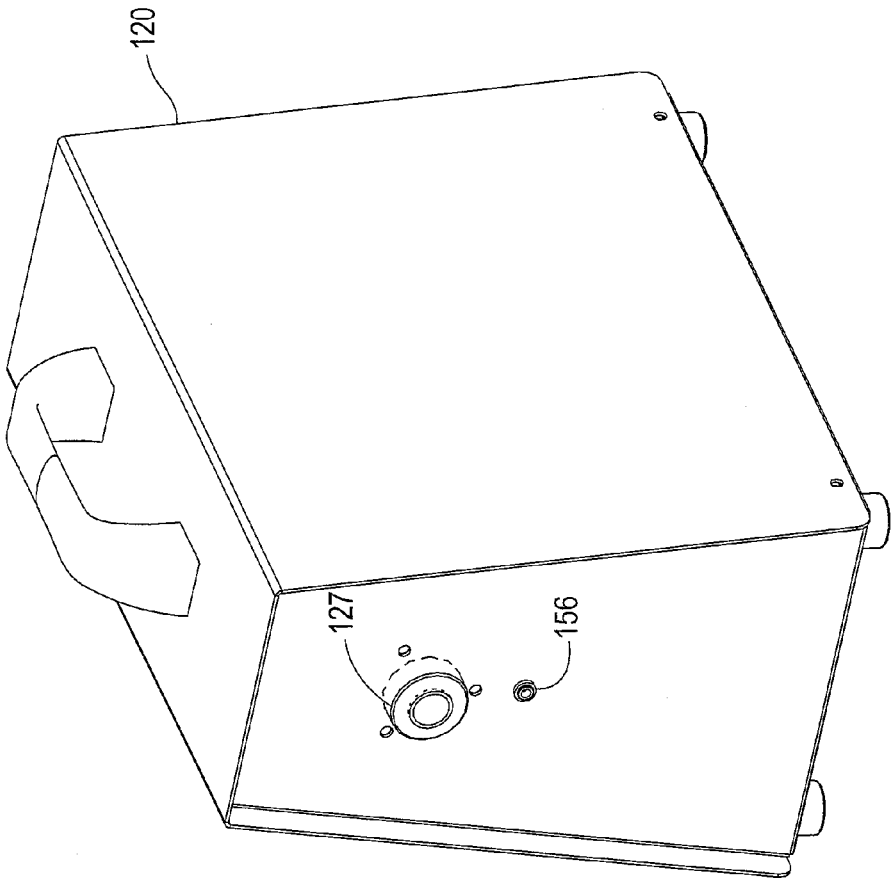


Fig. 11



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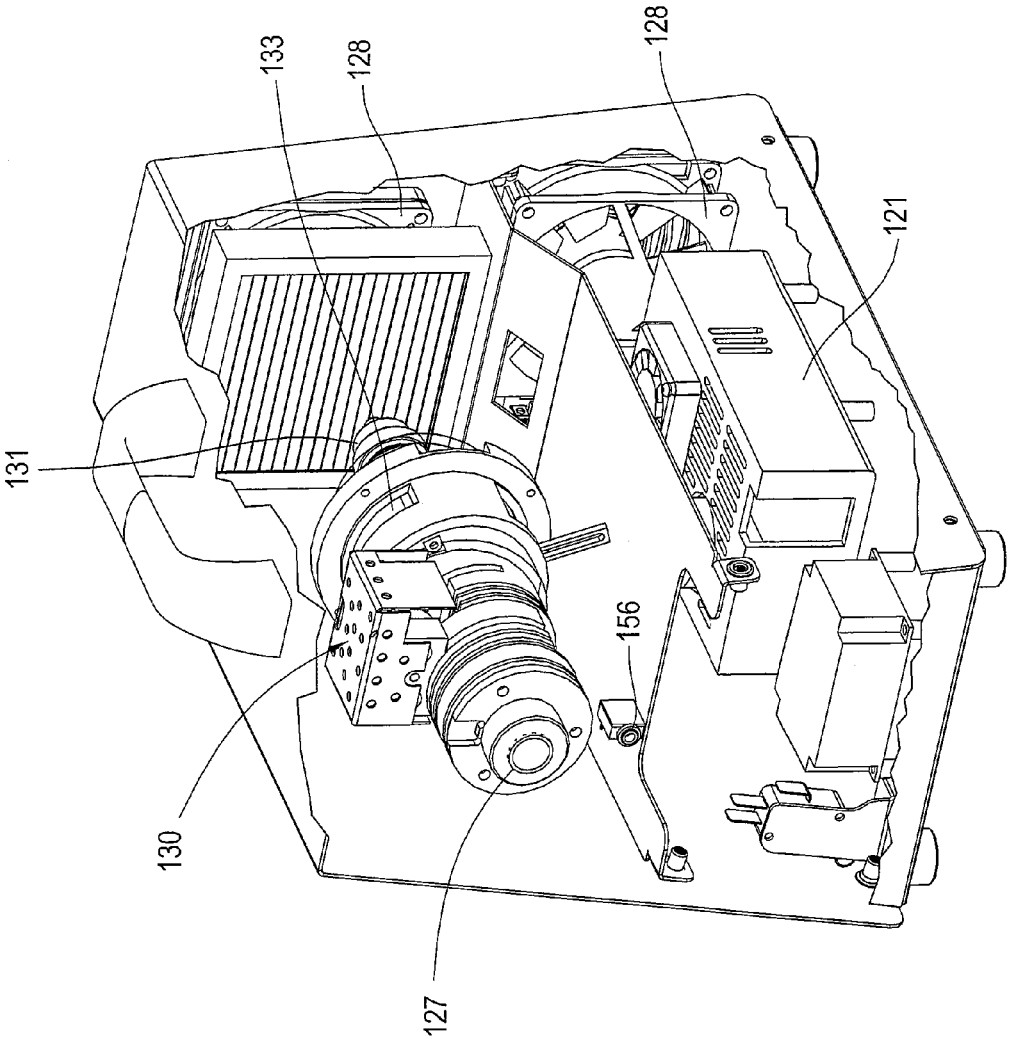


Fig. 13

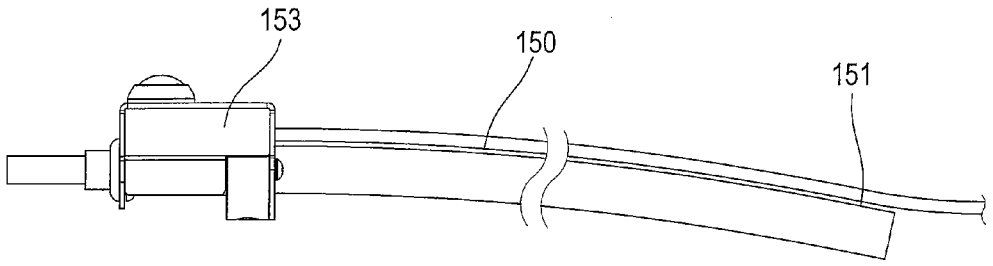
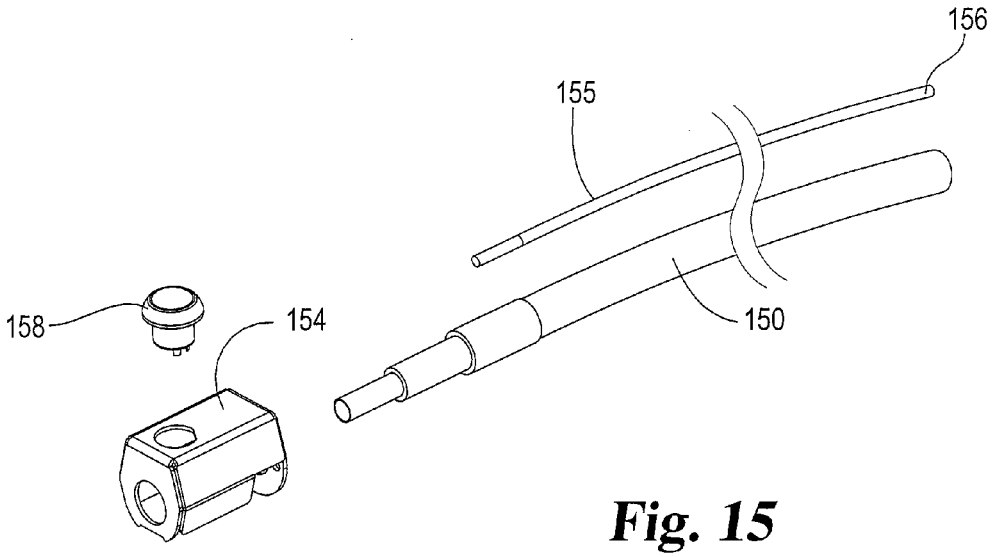


Fig. 14



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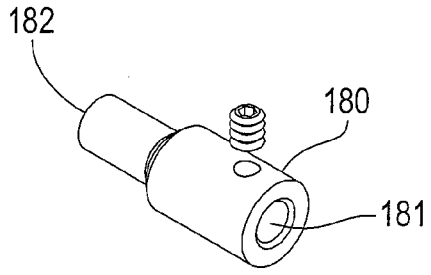

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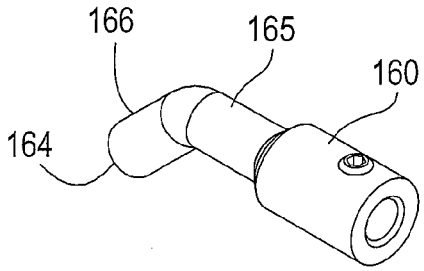

Fig. 17

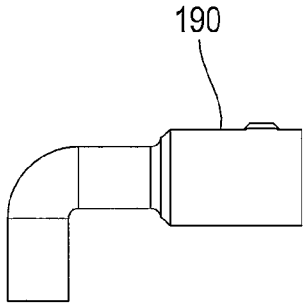

Fig. 18

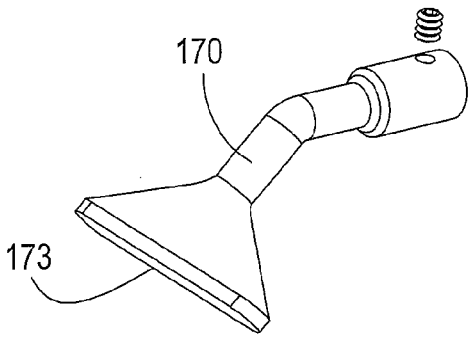

Fig. 19

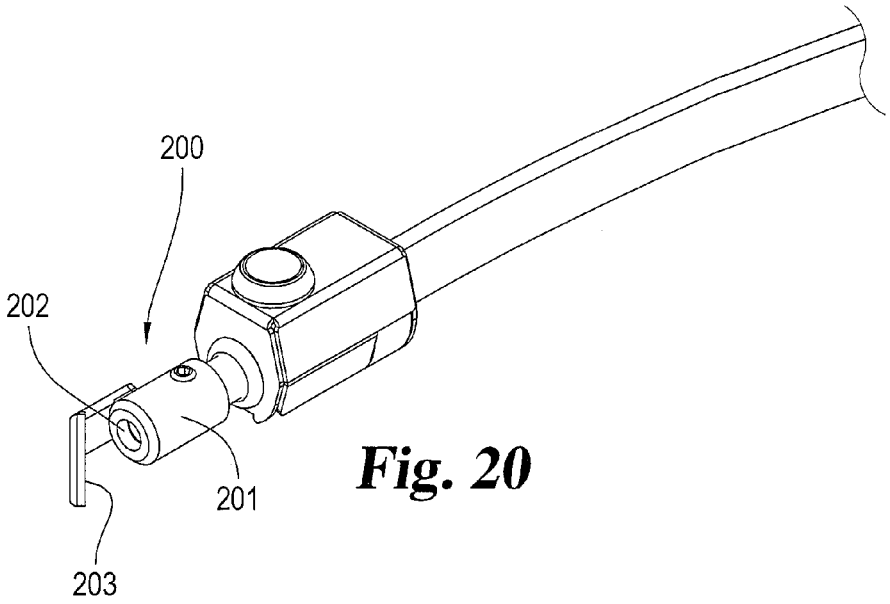

Fig. 20

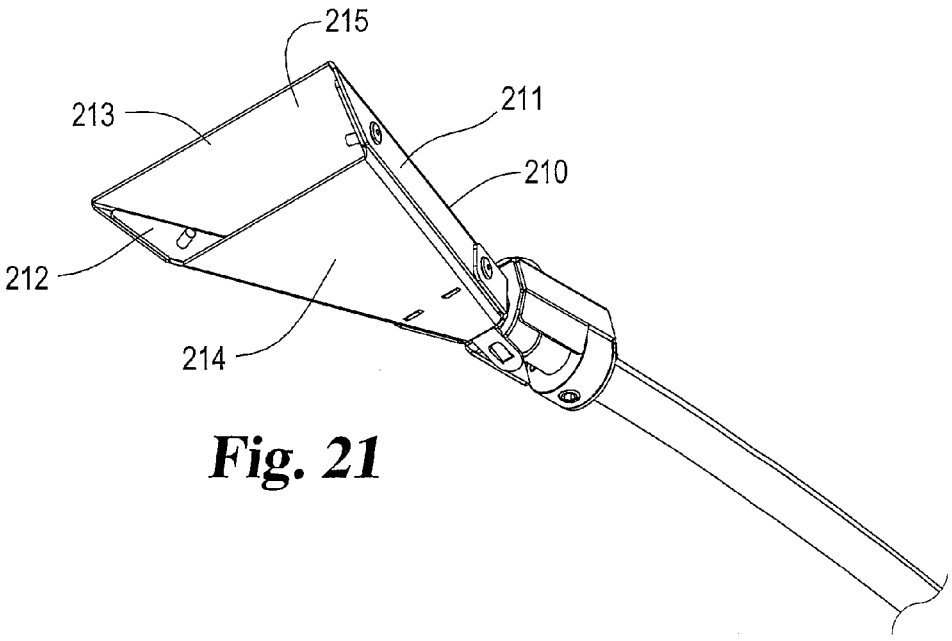

Fig. 21

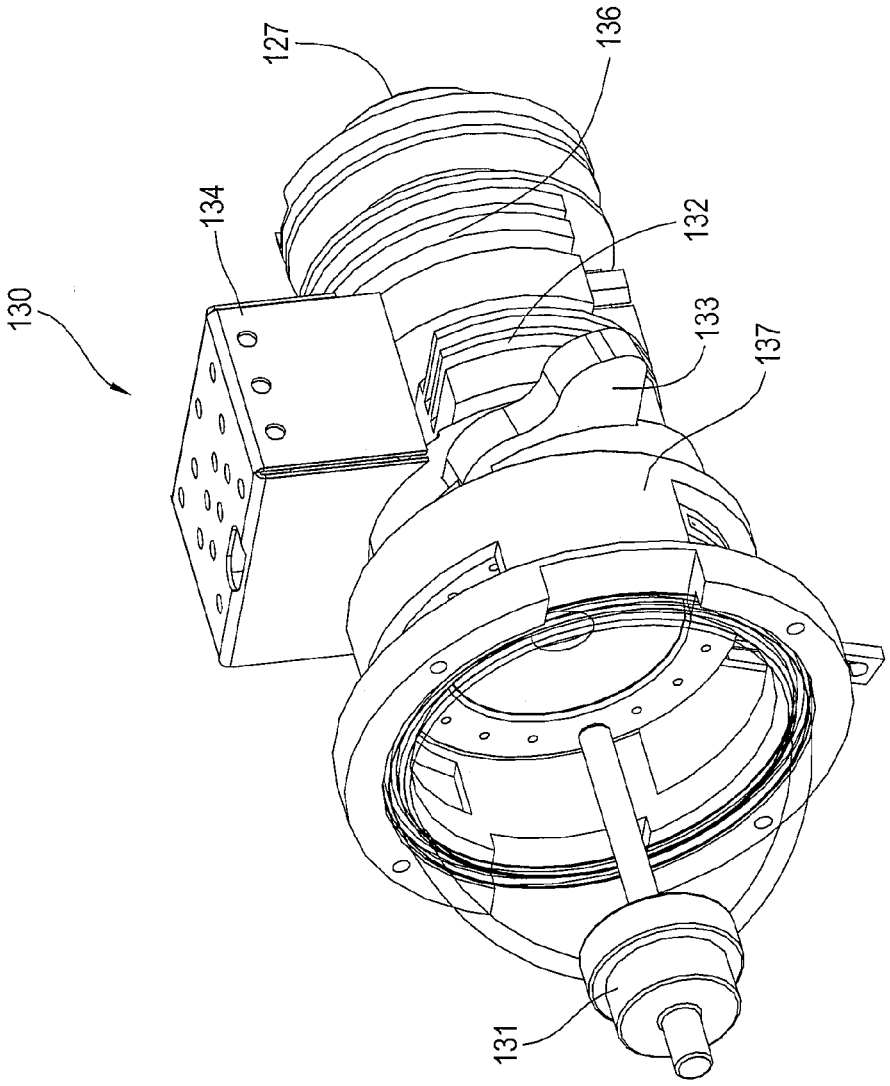

Fig. 22

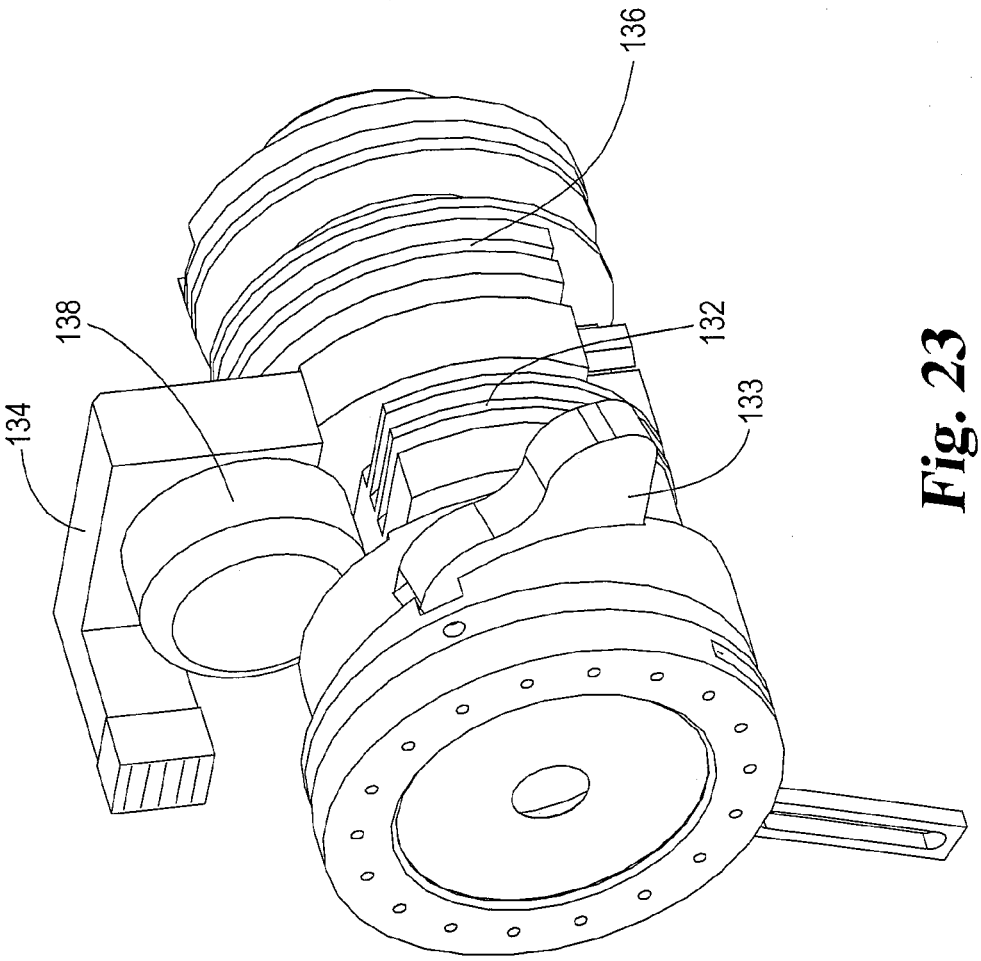

Fig. 23

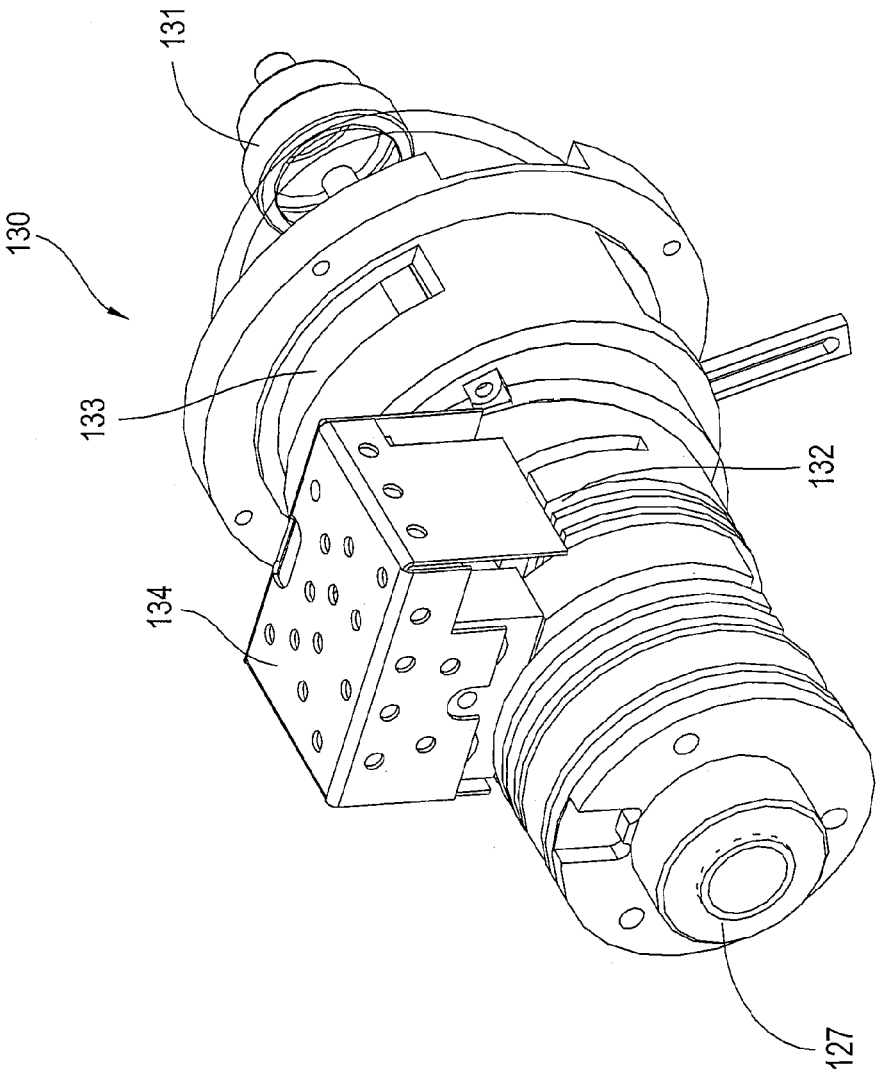

Fig. 24

ULTRAVIOLET SANITIZER WITH WAND

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to the field of apparatus and methods for sterilizing various surfaces.

2. Description of the Prior Art

In U.S. Pat. No. 8,431,075 there is described a method and apparatus for destroying infectious material present on a field used for various activities including sports. A vehicle is moved across the field and includes downwardly shining ultraviolet lamps that expose the synthetic grass blades to ultraviolet radiation. Prior to the exposure, brushes are used to contact the blades and position the blades so that they extend upwardly towards the light. As the vehicle quickly moves across the field, the infectious material is destroyed thereby providing a more efficient result without spraying the field with chemicals as used in the prior sterilization methods.

Heretofore, ultraviolet radiation has been used to destroy infectious materials present within various medical facilities, such as, surgery rooms. Thus, it is known to destroy infectious material using ultraviolet radiation.

While the generation of ultraviolet, type C (UVC) radiation for the purpose of sterilization of surfaces is not a new idea, the traditional handheld products on the market can only disinfect easy accessible areas. Left are unsterilized surfaces that are in gaps, cracks, crevasses, corners, inside tubing, pipes and boxed in areas. Disclosed herein is a method and device to direct a narrowly focused high powered beam of UVC radiation through a flexible tube. The distal end of the tube is then placed into the ordinarily unreachable areas that are to be disinfected causing the UVC radiation to eradicate genus, etc.

Various approaches have been used in decontaminating surfaces through the use of ultraviolet light. For example, in U.S. Pat. No. 7,459,694, there is disclosed a mobile germicidal system for decontaminating walls and a ceiling of a room. Germicidal lamps are positioned adjacent the wall and/or ceiling to thereby sterilize the surface. U.S. Pat. No. 5,902,552 discloses an ultraviolet air sterilization device for connection to an air handling duct for the purpose of sterilizing the air as it flows through the duct. U.S. Pat. No. 5,968,445 discloses a wheeled carriage with a handle to allow the operator to move the sterilization device over a floor.

An apparatus using ultraviolet light is disclosed in U.S. Pat. No. 6,272,768 for treating an object. A handheld device for moving across a surface to eradicate undesirable elements thereon is disclosed in U.S. Pat. No. 7,626,187. U.S. Pat. No. 8,226,887 discloses a mobile disinfectant device and method using ultraviolet light to sterilize a surface. A UV spot curing system for hardening epoxy material using a wand emitting ultraviolet light is available from American Ultraviolet under Model Spectrum 100.

SUMMARY OF THE INVENTION

One embodiment of the present invention is an ultraviolet sanitizer with a wand comprises a main housing and an electrical power supply. A fan is mounted to the main housing and connected to the power supply operable to interiorly cool the housing. A generator is connected to the power supply operable to generate ultraviolet radiation and the generator has an ultraviolet radiation emitting outlet. A flexible wand has a main body to transmit ultraviolet radiation. The wand has a proximal end connected to the ultraviolet radiation emitting outlet of the generator to receive the ultraviolet radiation and further has a distal end to direct the ultraviolet radiation against the surface to be sanitized.

Another embodiment of the present invention is a flexible wand directs radiation from a source of radiation toward a surface for sanitation thereof and comprises a flexible main body to transmit radiation from a source of radiation toward a surface for sanitation of the surface. The main body has a wand proximal end connectable to the source of radiation to receive the radiation therefrom and a wand distal end to direct the radiation against a surface to be sanitized. A tip is mounted to the wand distal end to direct the radiation from the wand against a surface to be sanitized.

An object of the present invention is to provide a flexible wand to dispense UVC radiation against surfaces to be sanitized.

It is an object of the present invention to provide a handheld wand that may be swiped across a hard to reach area to destroy infectious material thereon.

A further object of the present invention is to provide a convenient and portable ultraviolet sanitizer that dispenses radiation via a flexible wand toward the surface to be sanitized.

A further object of the present invention is to provide a mobile apparatus that is used direct a narrow focus UVC radiation beam towards unsterilized surfaces in gaps, cracks, crevasses, corners, inside tubing, pipes and boxed in areas.

Related objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of the alternate embodiment of a portable device for emitting UVC radiation;

FIG. **2** is a rear view of the device of FIG. **1**;

FIG. **3** is a right side view of the device of FIG. **1**;

FIG. **4** is an internal diagram depicting various components within the device of FIG. **1**;

FIG. **5** is a diagram illustrating the radiation emitter within the device of FIG. **1** and located in front of a parabolic reflector directing the radiation beam into a filter;

FIG. **6** is a sketch of a cylinder holding the wave length filter, and shutter;

FIG. **7** is an enlarged end view of the cylinder of FIG. **6**;

FIG. **8** is a view of the radiation wand;

FIG. **9** is an enlarged side view of a 5 mm tip mounted to the distal end of the wand of FIG. **8**; and

FIG. **10** is an enlarged side view of a broad tip mountable to the distal end of the radiation wand of FIG. **8**.

FIG. **11** is a rear perspective view of the preferred embodiment of the portable device for emitting UVC radiation.

FIG. **12** is a front perspective view of the device of FIG. **11**.

FIG. **13** is the same view as FIG. **12** only showing the outer housing fragmented illustrating the inner components.

FIG. **14** is a fragmentary side view of the wand mountable to the device of FIG. **11**.

FIG. **15** is a fragmentary exploded view of the wand of FIG. **14**.

FIG. **16** is an enlarged perspective view of the straight tip mountable to the distal end of the wand of FIG. **14**.

FIG. **17** is an enlarged perspective view of an angled tip mountable to the distal end of the wand of FIG. **14**.

FIG. **18** is an enlarged side view of a right angle tip mountable to the distal end of the wand of FIG. **14**.

FIG. **19** is an enlarged perspective view of a spreader or fan tip mountable to the distal end of the wand of FIG. **14**.

FIG. **20** is a perspective view of an angle reflector mounted to the wand distal end.

FIG. **21** is a perspective view of a reflector fan tip mounted to the wand distal end.

FIG. **22** is an enlarged perspective view of the lamp generator looking from lamp **131** (FIG. **13**).

FIG. **23** is the same view as FIG. **22** only with the arc lamp removed therefrom.

FIG. **24** is an enlarged perspective view of the light generator **130** shown in FIG. **13**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

The ultraviolet sanitizer **20** (FIG. **1**) includes a enclosure made from metal, such as 12 gauge aluminum sheet, forming a generally rectangular or square interior to house the main components of the sanitizer. While the enclosure may take a variety of shapes, in one embodiment, sanitizer **20** consists of two halves mechanically fastened along a vertical seam. The enclosure houses an internal power supply **21** (FIG. **4**), an arc lamp **22**, a parabolic reflector **23**, a shutter **24**, a culminator **25**, and a wavelength filter **26**. The outlet **27** is mounted to the enclosure and provides a means for the focused radiation to be directed outwardly of the sanitizer. A housing fan **28** is mounted to the enclosure to remove heat generated by the arc lamp. The sanitizer shown in FIGS. **1-10** illustrates the alternate embodiment of the sanitizer assembly, whereas the preferred embodiment of the sanitizer is illustrated in the remaining figures starting with FIG. **11**.

The light source is a CW arc lamp model 7515 or equal and is operable to generate ultraviolet radiation, type C having a wave length of approximately 100 to 290 nanometers. The lamp is a short arc mercury vapor bulb contained in a separate enclosure within the outer enclosure to ensure against UVC light leakage. The lamp enclosure **30** (FIG. **5**) may be produced from a variety of metallic materials. For example, a 12 gauge aluminum sheet may be used to form a generally square or rectangular enclosure. Inside interior box **30** is mounted the arc lamp **22** in front of the parabolic reflector **23** which focuses the energy produced by the lamp into an aluminum cylinder **31** (FIG. **5**) mounted in front of the lamp **22** and contained within interior box **30**. A variety of parabolic reflectors may be utilized such as available from Edmunds Optical.

The metal cylinder **31** dissipates heat generated from the lamp **22** and cooperates together with fan **28** (FIG. **4**) to dissipate heat from the sanitizer thereby increasing the life thereof. Further, the cylinder serves as a mechanism for holding an infrared wave length filter **26** (FIG. **6**), such as available from Edmunds Electronics. The filter is operable to remove infrared light, typically extending from the nominal red edge of the visible spectrum at 0.74 micrometers to 0.3 mm. In addition, cylinder **31** holds in place the culminator **25** that is located on the opposite sides of the wavelength filter **26**. The culminator focuses the radiation into a narrow beam which then exits via outlet **27**. Arc lamp **22** is operable to generate not only ultraviolet, type C radiation but other wavelengths. The parabolic reflector **23** concentrates the radiation emitted by the lamp to pass into cylinder **31** wherein the filter is operable to eliminate some frequencies other than the UVC radiation and focuses the radiation in a narrow beam via the culminator **25** eventually exiting interior enclosure **30** and the sanitizer **20** into the flexible wand **50** (FIG. **3**) directed against the surface to be sanitized.

Cylinder **31** includes a passage **40** (FIG. **7**) through which the UVC radiation is directed. A shutter **24** is slidably mounted to cylinder **31**. The shutter may be produced from a carbon steel material and is movable by an electromagnet **42** (FIG. **5**). The magnet is operable to move the shutter to block passage **40** preventing the UVC beam from moving through passage **40** and is also operable to move the shutter apart from the passage to allow the beam to pass through the passage and eventually to the wand. An on/off switch may be provided on sanitizer **20** and/or the distal end portion of the wand to allow the operator to turn on and off the system thereby controllably directing the amount of UVC radiation against the surface to be sanitized. Various alternatives may be provided for construction of the operation of the shutter. In one embodiment, deactivation of the magnet allows the shutter **24** (FIG. **7**) to drop into the cylinder thereby blocking passage **40** whereas with the electromagnet energized, the shutter is withdrawn apart from the passage **40**.

Light guide **50** (FIG. **8**) is operable to guide the UVC radiation from outlet **27** (FIG. **4**) whereat the wand proximal end **51** is mounted. The light guide is available from Lumatec under Series 250 and includes an aqueous solution of NaH2PO4 contained within a fluorocarbon polymer flexible tube sealed at the ends with quartz plugs to contain the fluid and transmit light at the desired light wave lengths of 220 to 280 nanometers. A light guide may be used such as Oriel Instruments DUV series or Newport's Model 76840. The length of the flexible light guide should be not shorter than 39.4" to accommodate easy application of the UVC light.

At the distal end of the light guide is a switch, push button or otherwise, activated by the users thumb to control the position of shutter **24** thereby allowing or disallowing light to be directed through passage **40** (FIG. **7**). The switch and the wires to the switch are fixed to the light guide via shrink tubing and are encased with cross-woven protective nylon fabric along the entire length of the guide being secured to each end with shrink tubing. The proximal end **51** of the light guide plugs into the exit **27** of the aluminum cylinder **31** as well as the wires from the push button switch that utilize a 3 mm plug into the face of the outer enclosure of the sanitizer.

At least two interchangeable tips **60** (FIG. **9**) and **70** (FIG. **10**) may be selected to help direct UVC light to the area to be sanitized more effectively and ergonomically depending on the application. The proximal end **61** of tip **60** plugs into the distal end **52** of light guide **50** with the main body **62** of the tip being generally cylindrical in configuration with the proximal end portion of the tip arranged at an obtuse angle **63** thereby allowing the tip distal end **64** to be conveniently positioned adjacent the area to be sanitized. The diameter of the main body **62** is 5 mm. Tip **60** may be produced from aluminum tubing approximately four inches long with obtuse angle **63** being approximately 150 degrees. Variations in tip **60** are included in the present invention. For example, angle **63** may be 135 degrees or any angle that facilitates the positioning of the distal end portion. Likewise, the diameter of the main body **62** may be less than or greater than 5 mm. In one embodiment, the main body **71** (FIG. **10**) of tip **70** broadens out to a distal end **73** of approximately 6 inches whereas the mounting end portion of main body **71** may be 154 mm.

Advantages of the present invention will be apparent from the above description. For example, the device is portable

being lightweight and relatively small in size. The device and method have a dual purpose in that broad surfaces as well as narrow areas may be sanitized. The remote shutter operation provides for not only safety but also control of the amount of radiation to be applied to the surface. In one embodiment, the device has a high power input thereby providing a fast and effective treatment with the range of power output being variable between 3.5 watts to 6000 micro watts. The supplied radiation is 3.5 watts at the tip with a frequency of 254 nm.

The broad tip **70** has a truncated main body **71** with the proximal end **72** extending into the distal end **52** of light guide **50**. The opposite end **73** of main body **71** has a large diameter thereby allowing the emitted radiation to be spread over a larger area as compared to tip **60**. Tip **70** is particularly useful in sanitizing large flat areas.

The method of use of sanitizing a surface with the device disclosed herein includes various steps. First, the power supply **21** (FIG. **4**) is connected via power cord **80** to a suitable source of current. The distal end of the wand is grasped and positioned at one end of the surface to be treated. The user applies the UVC dosing by activating the thumb switch moving the shutter **24** (FIG. **7**) apart from passage **40**. The tip of the wand is moved in one direction in a swiping motion at approximately 10 centimeters per second at a right angle to the gap containing the contaminated material. The motion of the wand tip is then reversed pulling the wand back with the same swiping motion while turning the light guide to a 45 degree angle to the left or right of the surface to be treated. The wand can then be moved in a swiping motion in the opposite direction at an angle to the surface to be treated at 135 degrees. This method can ensure the UVC flowing from the tip of the wand will produce different angles of incidence upon the target surface thereby reflecting UVC light to all areas of the treatable area.

Another method to treat a mold area inside a wall or cabinet is to first open an insertion point large enough for the guide to enter. The guide is then inserted through the opening to abate the mold infested blind or hidden areas. Using time and dosage calculations suitable for the application, the guide is then moved in a fashion that illuminates the hidden area with adequate UVC saturation to achieve mold abatement. Use of an optical viewing fiber in conjunction with the sanitizer to see into the blind areas may be useful in certain situations.

The larger wand tip **70** may be used for flat surfaces such as counters, tables or work areas. Using a waving motion within 2 centimeters of the contaminated surface at an approximate motion of 10 centimeters per second is useful. The tip can also be in contact with the surface area using the same method and speed. Some of the various components for the sanitizer are commercially available. For example, the bulb within the arc lamp may be obtained from Sylvania Osram under Model HBO 50 W AC L1 with the electromagnet being obtained from AWP. Various switches and power cords are available from a variety of sources. A power supply **21** for powering the various components of sanitizer **20**, such as CW Arc mdl 7515 from Hello trade is suitable.

The preferred embodiment of the sanitizer shown in FIGS. **11** and **12**. Sanitizer **120** includes a conventional metal enclosure with a handle provided to allow the sanitizer to be carried. The sanitizer includes a power cord **180** extendable from the sanitizer housing to a suitable source of electrical energy for powering the internal power supply and the lamp within the housing thereby generating the ultraviolet radiation emittable from the flexible wand **150** (FIG. **14**) having its proximal end **151** connected to the outlet **127** (FIG. **12**). A conventional manual on/off switch **181** (FIG. **11**) is provided at the rear of the housing to connect or disconnect the source of electrical energy to the internal components of the sanitizer.

Whereas the alternate embodiment shown in FIG. **2** has a single exhaust fan **128**, the preferred embodiment includes a pair of exhaust fans **128** (FIG. **13**) mounted to the rear wall thereof to provide cooling of the light source within the sanitizer.

A conventional electric plug **180** (FIG. **11**) connects the external source of electrical energy to the internal power supply **121** (FIG. **13**) located within the sanitizer housing. Power supply **121** is connected to the light generator **130**. The sanitizer housing is fragmented in FIG. **13** showing the conventional components of the preferred embodiment of the present invention. Power supply **121** is commercially available under Part No. E5b1055 from American Ultraviolet, 212 S. Mt. Zion Road, Lebanon, Ind. 46052. The power supply is connected to the light generator **130** (FIG. **22**) which includes an arc lamp **131** consisting of a light source surrounded by a parabolic reflector, a shutter **132**, a filter **133**, a culminator **136**, and an outlet **127**. The arc lamp and parabolic reflector **131** is commercially available under Part Number LPB 1014 from American Ultraviolet. The combined bulb and reflector **131** is attached to housing unit **137**, in turn, including a removable filter **133**, and a culminator **136**. Housing unit **137** with the filter and culminator are available from American Ultraviolet under Part No. SSM3055. Filter **133** is slidable into the hollow interior housing unit **137** to block long wave lengths of the radiation emitted by bulb and reflector **131**. An electromagnet **138** (FIG. **23**) is mounted to enclosure **134**, in turn, mounted to housing **137**. Electromagnet **138** is operable to move shutter **132** to block, or control the amount of radiation emitted by the lamp and reflector component **131**. Filter **133** is slidably mounted to housing **137** and may be pulled outwardly for replacement. The light generator **130** is operable to emit radiation via outlet **127** and includes UVC type radiation.

Wand **150** (FIG. **14**) has a flexible main body to transmit the UVC radiation from the source of radiation, namely generator **130** as filtered by infrared filter **133** toward the surface to be sanitized. The wand is shown as fragmented in FIGS. **14** and **15** since the main body of the wand is long and cannot be fully shown in the drawings. The main body of the wand has a proximal end **151** connected to the UVC outlet **127** (FIG. **12**) via a commercially available connector. At the distal end of the wand main body is a push button switch **153** (FIG. **14**) to control the flow of UVC radiation outwardly from the wand.

Switch **153** includes a switch housing **154** (FIG. **15**) having a push button control **158** movably mounted thereon. Housing **154** is mounted to the distal end of wand **150** by conventional fastening devices. A switch wire **155** has one end operatively connected to the switch **153** with the opposite end of the switch wire **155** extending through portal **156** (FIG. **12**), in turn, connected to the electro-magnet **138** (FIG. **23**). The electro-magnet as previously discussed is operable to control the shutter **132** blocking or opening the passage from arc lamp **131** (FIG. **22**) to the outlet **127**. Thus, the user may grasp the distal end of the wand and direct the tip thereof towards the surface to be sanitized while activating or deactivating the flow of UVC radiation via operation of switch **153**.

In the preferred embodiment of the sanitizer, the flexible light guide is available from different sources of supply as discussed for the alternate embodiment. Excellent results have been obtained by using the liquid light guide from Newport Corp., 150 Long Beach Road, Stratford, Conn. 06615 under Model No. 76843. The flexible light guide is enclosed in a flexible inter woven fabric loom available from TECH-

FLEX, 29 Brookfield Dr., Sparta, N.J. 07871 under part number PTNO.63. The switch wire **155** may be secured to the main body of the flexible light guide by standard shrink wrap.

A variety of different types of tips are removably mountable to the distal end of the wand main body with each tip design to direct UVC radiation at a particular angle towards the surface to be sanitized.

Straight tip **180** is illustrated in FIG. **16** having an entrance aperture **181** to receive the distal end of the wand main body and a set screw to hold the wand to the tip. The UVC radiation then emits via outlet **182**. In order to direct the UVC radiation at an angle, an angled tip **160** is provided and is identical in construction with straight tip **180** with the exception that the distal portion **166** of tip **160** is arranged at an obtuse angle relative to the proximal end portion **165** of the tip with the UVC radiation then exiting via outlet **164**. In the case of straight tip **180**, the main body of the tip has an inner portion and an outer portion which are parallel or extends along a straight line thereby directing UVC radiation directly outward along the straight line from the wand. A variation of angle tip **160** is a right angle or 90 degree tip **190** having an outer portion arranged at 90 degrees with respect to the inner portion of the tip thereby directing the UVC radiation at a right angle relative to the wand.

In the case of the tips shown in FIGS. **16-18**, the main body of the tip is cylindrical in configuration. A spreader or fan tip **170** is illustrated in FIG. **19** wherein the outer cylindrical portion of the tip diverges thereby directing the radiation over an area larger than the diameter of the main body of the tip.

In lieu of allowing the radiation simply to exit the distal end of the particular tip utilized, a pair of reflector tips are shown in FIGS. **20** and **21**. Reflector tip **200** includes a cylindrical portion **201** parallel with the distal end of the wand. The UFC radiation exits the reflector portion **201** via outlet **202** and is then reflected by a mirror type surface **203** arranged at obtuse angle relative to cylindrical portion **201**. Reflector tip **210** has a pair of diverging side walls **211** and **212** joined to a diverging upper **213** wall and diverging lower wall **214** forming an expanding fan tip with the radiation exiting outlet **215** over a larger surface as compared to tips **160**, **180** and **190**.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

What is claimed is:

1. An ultraviolet sanitizer with wand comprising:
- a main housing;
- an electrical power supply;
- a fan mounted to said main housing and connected to said power supply operable to interiorly cool said main housing;
- a generator connected to said power supply operable to generate ultraviolet radiation, type C, with a power output between 3.5 watts and 6.0 watts, said generator having an ultraviolet radiation emitting outlet; and,
- a flexible wand having a main body to transmit ultraviolet radiation, said wand having a wand proximal end connected to said ultraviolet radiation emitting outlet of said generator to receive said ultraviolet radiation and a wand distal end to direct said ultraviolet radiation in the amount between 3.5 watts and 6.0 watts at said distal end against a surface to be sanitized; and wherein said generator includes a lamp, a movable shutter and an electromagnet to move said shutter, said shutter positioned between said radiation emitting outlet of said generator and said lamp, said wand distal end includes a manual switch thereon operatively connected to said electromagnet to move said shutter and control flow of ultraviolet radiation from said lamp to said radiation emitting outlet of said generator.

2. The sanitizer of claim **1** wherein:
said generator includes a reflector to focus radiation from said lamp.

3. The sanitizer of claim **2** wherein:
said generator includes a culminator located between said arc lamp and said outlet of said generator to focus radiation into a beam.

4. The sanitizer of claim **3** wherein:
said generator includes an infrared filter and an enclosure, said enclosure has said lamp, said reflector, said culminator, and said filter mounted therein, said enclosure is mounted within said main housing.

5. The sanitizer of claim **1** wherein and further comprising:
a radiation directing tip having a main body with a tip proximal end removably mountable on said wand distal end and a tip distal end to direct ultraviolet radiation against a surface to be sanitized, said main body extends from said tip proximal end to said tip distal end and includes a first portion located at said proximal end and a second flared portion located at said distal end spreading radiation against the surface being sanitized, said main body of said tip has a lower wall, a top wall and a pair of side walls joined together with said lower wall and said top wall diverging apart from said tip proximal end to said tip distal end and side walls diverging apart from said tip proximal end to said tip distal end forming an expanding fan tip.

6. The sanitizer of claim **1** wherein and further comprising:
a radiation reflecting tip having a main body with a tip proximal end removably mountable on said wand distal end and a tip distal end to direct by reflecting ultraviolet radiation against a surface to be sanitized, said main body extends from said tip proximal end to said tip distal end and includes a first portion located at said proximal end and a second portion located at said distal end reflecting radiation against the surface being sanitized, said main body has a cylindrical portion parallel with the distal end of the wand with the cylindrical portion having an outlet with a reflector portion with a mirror type surface arranged at an obtuse angle relative to said cylindrical portion.

7. The sanitizer of claim **1**, further comprising:
a broad radiation directing tip having a much larger diameter than said flexible wand.

8. The sanitizer of claim **1**, further comprising:
a reflector tip including:
- a coupling portion removable attachable to said flexible wand
- a flat mirror aligned with said flexible wand when said coupling portion is attached to said wand, wherein said flat mirror is arranged at an obtuse angle to said flexible wand.

9. The sanitizer of claim **1**, further comprising:
a reflector tip including:
- a pair of diverging side walls;
- a diverging upper wall; and
- a diverging lower wall, wherein the diverging side walls, upper wall and lower wall form an expanding fan tip with an enlarged radiation exiting outlet.

10. The sanitizer of claim 1, further comprising a reflector coupled to said flexible wand, wherein said reflector is located distally from said wand radiation outlet.

11. A UV sanitizer with wand comprising:

an electrical power supply;

a generator of ultraviolet radiation, type C, with a power output between 3.5 watts and 6.0 watts, said generator having a generator radiation outlet with said generator including a lamp, a movable shutter and a mechanism to move said shutter;

a flexible wand having a flexible main body to transmit said radiation from said generator, said wand having a proximal end connected to said generator radiation outlet and a distal end forming a wand radiation outlet to direct said radiation in the amount between 3.5 watts and 6.0 watts against a surface to be sanitized; and,

a manual electrical switch mounted on said distal end of said wand, said shutter positioned relative to said lamp and wand radiation outlet to control flow of radiation from said lamp and through said wand radiation outlet, said switch connecting said mechanism to said power supply to move said shutter by said mechanism controlling flow of radiation out of said wand radiation outlet.

12. The UV sanitizer of claim 11 wherein said mechanism is an electro-magnet, said wand is a light guide for transmitting at 220 to 280 nanometers.

13. The UV sanitizer of claim 11 and further comprising a filter limiting passage of UV radiation to said wand radiation outlet; and, a parabolic reflector to focus radiation from said lamp.

14. The UV sanitizer of claim 13 and further comprising a culminator to focus radiation into a beam.

15. The UV sanitizer of claim 11 and further comprising a radiation tip mounted to said distal end of said wand, said tip having a lower wall, a top wall and a pair of side walls joined together with said lower wall and said top wall diverging apart from said distal end of said wand and side walls diverging apart from said distal end of said wand forming an expanding fan tip.

16. the UV sanitizer of claim 11, further comprising a reflector coupled to said flexible wand, wherein said reflector is located distally from said wand radiation outlet.

17. The sanitizer of claim 11, further comprising:

a broad radiation directing tip having a much larger diameter than said flexible wand.

18. The sanitizer of claim 11, further comprising:

a reflector tip including:

a coupling portion removable attachable to said flexible wand

a flat mirror aligned with said flexible wand when said coupling portion is attached to said wand, wherein said flat mirror is arranged at an obtuse angle to said flexible wand.

19. The sanitizer of claim 11, further comprising:

a reflector tip including:

a pair of diverging side walls;

a diverging upper wall; and

a diverging lower wall, wherein the diverging side walls, upper wall and lower wall form an expanding fan tip with an enlarged radiation exiting outlet.

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